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NEW JERSEY STATE DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. WOODBURY CREEK DAM (NJ00398), DELA--ETC(U)
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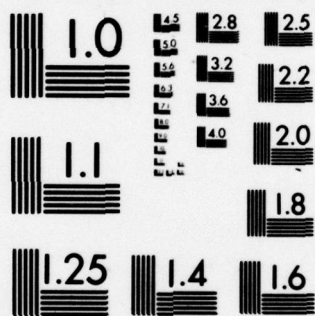
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GLOUCESTER COUNTY
NEW JERSEY

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WOODBURY CREEK DAM

NJ 00398

**PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM**



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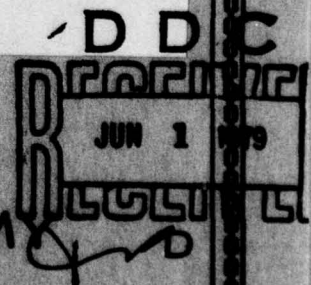
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DEPARTMENT OF THE ARMY

Philadelphia District
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Philadelphia, Pennsylvania

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February, 1979



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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		

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IN REPLY REFER TO

NAPEN-D

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
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11 MAY 1979

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Woodbury Creek Dam in Gloucester County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Woodbury Creek Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in good overall condition and the spillway is considered adequate. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. However, to assure the continued functioning of the dam and its impoundment, the following remedial actions could be undertaken:

- a. The owner should initiate a study to determine the feasibility of relocating the utility lines on the upstream side of the bridge in order to prevent blockage of the spillway during periods of high flow.
- b. Repair or replace the deteriorated rubble masonry retaining walls beyond the bridge wingwalls.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman James J. Florio of the First District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

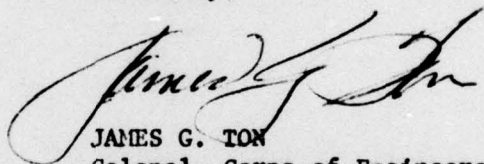
NAPEN-D

Honorable Brendan T. Byrne

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed action taken by the State to implement our recommendations.

Sincerely,



JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:

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Division of Water Resources
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John O'Dowd, Acting Chief
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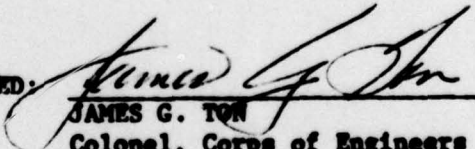
WOODBURY CREEK DAM (NJ00398)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 6 December 1978 by Louis Berger and Associates, Inc. under contract to the State of New Jersey. The State, under agreement with the U. S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Woodbury Creek Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in good overall condition and the spillway is considered adequate. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. However, to assure the continued functioning of the dam and its impoundment, the following remedial actions could be undertaken:

- a. The owner should initiate a study to determine the feasibility of relocating the utility lines on the upstream side of the bridge in order to prevent blockage of the spillway during periods of high flow.
- b. Repair or replace the deteriorated rubble masonry retaining walls beyond the bridge wingwalls.

APPROVED: 

JAMES G. TOM
Colonel, Corps of Engineers
District Engineer

DATE: 11 May 1979

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam Woodbury Creek Dam Fed ID# NJ 00398
NJ ID# 539


State Located New Jersey
County Located Camden
Coordinates Lat. 3950.5 - Long. 7509.0
Date of Inspection 6 December 1978

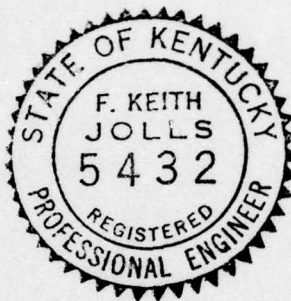
ASSESSMENT OF
GENERAL CONDITIONS

The Woodbury Creek Dam is assessed to be in an overall good condition and it is recommended to be downgraded from a high hazard to a low hazard category. Overtopping of the dam would not significantly increase the danger of loss of life or property damage. No detrimental findings were uncovered to merit further study, either of a structural or hydraulic nature. The only recommended further action is to direct the owner to undertake a study in the future to ascertain if the water lines on the upstream side of the bridge could be relocated and the masonry retaining walls beyond the bridge wingwalls be repaired or replaced.

The spillway capacity is adequate and meets the requirements of the Recommended Guidelines for Safety Inspection of Dams, being able to accommodate

the 100-year frequency SDF. Moreover, because this dam is in a tidal zone, its hydraulic capacity is believed to be satisfactory in view of its intended purpose and the physical aspects of its location.


F. Keith Jolls P.E.
Project Manager





OVERVIEW OF WOODBURY CREEK DAM

DECEMBER 1978

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: WOODBURY CREEK DAM FED# NJ 00398

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Engineer District, Philadelphia to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Woodbury Creek Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The Woodbury Creek Dam consists of a double-walled system of steel sheet piling which forms a straight crest and apron slab immediately downstream from an old bridge carrying Broad Street (State Route 45) over Woodbury Creek. The ends of the piling system tie into the bridge's stone masonry abutments and are capped with 8" channels about four feet higher than the spillway crest (which is at El. 5.84). The sheeting is driven to El. -16+ and provides a total crest length of 64 feet. Two 36" Armco slide gates are installed just below

mean sea level and provide additional discharge capacity. Downstream of the crest sheeting line about 8 feet is a second row of sheeting. A concrete cap and apron slab (at El. -1.0) connect the two rows. Along the downstream channel on each bank exists dilapidated timber bulkheads.

The Broad Street bridge above the spillway has a clear span of about 35 feet and is about 70 feet wide (including sidewalks). The roadway approaches form the embankment portions of the dam which has an overall length of approximately 300 feet.

b. Location

Woodbury Creek Dam is located on State Highway 45 in the City of Woodbury, Gloucester County, New Jersey and is 1.4 miles south of the interchange of Route 45 and I-295.

c. Size Classification

The maximum height of the dam is 21+ feet at the spillway and the maximum storage is estimated to be 1,138 acre-ft. Therefore, the dam is placed in the intermediate size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

Based upon the Corps of Engineers criteria and the fact that in the event of a failure little damage would be sustained by downstream property or endanger human life, the classification of the dam is recommended to be downgraded to a low hazard category. With a clear tidal channel downstream and little development, a failure would cause little damage except to the dam itself.

e. Ownership

The dam is owned by the City of Woodbury.

f. Purpose of Dam

The dam was constructed to create a series of recreation lakes for the residents of Woodbury and provide mosquito control in the low swampy areas that naturally formed the lake bottom.

g. Design and Construction History

The dam was first proposed in 1927 but due to encroachment complaints and bureaucratic considerations no action was taken at that time. The dam was finally constructed in 1960 by J.D. Moore, Inc. from a design by John G. Reutter & Associates, Consulting Engineers. The design incorporated the existing highway and bridge embankment of Route 45 and provided a double-walled steel sheeting spillway structure 13' west of the bridge fascia. Prior to construction, the Broad Street Lake area consisted of tidal marshlands and breeding grounds for mosquitos; one condition which prompted the recommendation for the dam at this site. The construction was completed in 1961 on lands donated by the Gloucester County Conservation Society, Public Service Electric and Gas, Sun Oil and several private citizens. It is unknown exactly when the highway bridge was built but is estimated to have been around the turn of the century.

h. Normal Operating Procedures

The dam forms Stewart Lake and normal operations are minimal as the reservoir has considerable freeboard and clear landscaped banks. City engineering personnel manage the cleaning and maintenance of the reservoir and dam (see Section 4).

1.3 PERTINENT DATA

a. Drainage Area

The drainage area of Woodbury Creek Dam is 5.0 square miles.

b. Discharge at Dam Site

A non-damaging spillway capacity with the reservoir at the top of the steel sheeting wingwalls (El. 9.84) is 1536 cfs. For maximum capacity, see Section 5. No discharge records are available at this site.

c. Elevation (above M.S.L.)

Top of dam - +18.8+ (bridge deck elevation)
Recreation pool - +5.84
Streambed at Centerline of Dam - -2+

d. Reservoir

Length of Recreation Pool - 6,000'
Length of Maximum Pool - 10,200'

e. Storage

Recreation Pool - 390 acre-feet
Top of Dam - 1138 acre-feet

f. Reservoir Surface

Top of Dam - 66 acres
Recreation - 49 acres

g. Dam

Type - Earth embankment with steel sheeting spillway affixed to highway bridge.

Length - 300'

Height - 35' ± (bridge deck to sheeting tip)

Freeboard between normal reservoir and top of dam - 13'

Top width - 70'

Side Slopes - 1½H:1V

Zoning - None

h. Diversion and Regulating Tunnel

None

i. Spillway

Type - steel sheeting, sharp crested weir

Length - 64'

Crest Elevation - +5.84'

j. Regulating Outlets

2 - 36" Ø Armco slide gates in spillway face

Inv. El. -0.5₊

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design plans or computations were available. However, the Engineering staff of the City of Woodbury provided a plan and section thru the spillway which is in substantial agreement with what was inspected in the field. No data was available regarding the design of the adjoining bridge which forms the 35 foot (effective width) approach channel to the spillway crest.

2.2 CONSTRUCTION

The dam was purportedly constructed in accordance with the design although no as-built drawings were located. The northwest wingwall layout was modified during construction and was built at roughly a 45° angle to direct the flow back towards the natural channel of Woodbury Creek.

2.3 OPERATION

The dam appears to be functioning satisfactorily as designed and built. There is no day to day operation.

2.4 EVALUATION

a. Availability

In view of the size and hazard condition, the availability of design data is considered satisfactory for conducting the Phase I Inspection and evaluating the safety of the dam.

b. Adequacy

Referring to the above, the engineering data is deemed to be adequate for the analysis required for this inspection.

c. Validity

The information regarding the steel sheeting in the spillway is considered valid as the field inspection revealed nothing to challenge the available design data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspections were conducted on December 5 and 6, 1978 and revealed a constant discharge of 4 to 6 inches flowing over the spillway crest. Discussions were also held with City engineering and maintenance personnel regarding the history and operational aspects of the dam.

b. Dam

In general, the steel sheeting and the eight foot wide concrete apron slab are in satisfactory condition although the apron and cut-off wall are continually submerged. There was no evidence of seepage because the original ground areas immediately downstream from each side of the roadway embankment are either at spillway crest elevation or slightly higher. The roadway approach sections to the bridge which form the embankment portion of the dam are considerably higher than that dictated by hydraulic considerations (having been built at a much earlier time for a different purpose) and judging from the age of the bridge, have been in place over eighty years. The road shows evidence of widening and repaving (numerous times) but the only problem areas observed are at the curb catch basins. These appear to be a continuous maintenance problem. The embankment is excessively wide (as a dam) in relation to the height. The roadway profile in this area is on a sag vertical curve with the low point to the north of the bridge. The interlocked steel sheeting spillway which regulates the impoundment is, in effect, an addition to the bridge structure. The bridge was apparently designed at an earlier time to merely handle the normal flow of Woodbury Creek and to keep the roadway above maximum high tide (El. 11.5+).

c. Appurtenant Structures

The hydraulic opening of the 35 foot bridge is more than adequate, having 7 feet of freeboard above the weir crest. However, the superstructure is very old and if inspected using present-day FHWA rating criteria, would undoubtedly be replaced or be subjected to extensive repairs. A collapse of the deck could substantially clog up the waterway opening underneath. On the upstream side of the bridge, a 15 inch water (or sewer) line exists about 4 feet above the lake level. This passes thru the bridge opening and continues along the northwest wingwall. There is also another 18 inch line which parallels the east fascia and is supported on concrete piers placed in the approach channel. Both block the hydraulic opening to a considerable degree. There are chain-link fences constructed on each side of the upstream fascia and appear to be placed there to prevent vandalism. The bridge abutments and wingwalls are constructed of ashlar stone masonry but excepting for the conditions of the joints, are of solid, massive construction and most probably are founded on piles in view of the soft black clay foundation material revealed by test borings. Their plumbness and alignment are true. However, the masonry work beyond the ends of the dimension stone wingwalls is of very poor quality.

The two sluice gates have not been adjusted in several years but are reportedly in operative condition. With the continual tidal fluctuations, their usefulness is somewhat questionable.

d. Reservoir Area

The Stewart Lake (as the Broad Street pond is locally called) is divided by the high embankment of the Pennsylvania-Reading Seashore Railroad approximately 900 feet upstream. Above that, the reservoir is further divided by connecting drainage structures at Evergreen Avenue, Hunter Street and

Cooper Street. All are considerably above the normal lake level and have hydraulically adequate openings. The banks of the reservoir are well defined and have relatively steep but well-maintained side slopes. Only minor sloughing was noted in a few areas.

e. Downstream Channel

Woodbury Creek below the dam is a wide tidal marshland extending about 3 miles to its confluence with the Delaware River. Although there are several adjacent older residential areas, a sewage plant, an athletic field and high-rise development, all are substantially above record high tide (+11.5 MSL). The normal high tide appears to come up to an elevation just below spillway crest. The timber bulkheads that extends downstream along each side of the channel is completely deteriorated and of no value.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures were discussed with engineering personnel of the City of Woodbury who manage the maintenance and upkeep of the dam.

4.2 MAINTENANCE OF DAM

Little has been required in the way of maintenance. In 1968, the lake was dewatered and certain areas of the cap channels rewelded along the top of sheeting. Nothing has been required since in the way of repair.

4.3 MAINTENANCE OF OPERATING FACILITIES

There is virtually no day-to-day operation as the sluice gates are very infrequently used (mainly to dewater the reservoir).

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

No warning system exists except for monitoring by City personnel during heavy storms. A police station is located immediately to the southeast of the dam so that responsible City personnel are continually in the immediate vicinity.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

The present operational procedures and safeguards are deemed to be adequate in view of the position of the dam (no hazardous downstream residential areas) and the small size of the impoundment. In the opinion of the inspection team, the City has an experienced, well-managed staff which is fully capable of the execution of proper operational maintenance.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Based on the Recommended Guidelines for Safety Inspection of Dams, the dam at Woodbury Creek is of intermediate size and low hazard. In view of the dam's geometry and location, a design flood of a 100-year frequency event was selected by the inspection team. Inflow to the reservoir for the 100-year storm was computed utilizing precipitation data from Technical Publication 40 by the HEC-1 computer program. This gave a peak inflow to the reservoir of approximately 5700 cfs. When routed through the reservoir, the peak discharge was reduced significantly to 3620 cfs. The hydraulically restricted bridge opening has a maximum discharge capacity before overtopping of approximately 5,620 cfs. The spillway weir, being considerably wider than the bridge opening, has a much larger capacity and consequently, is not the controlling element. Therefore, the dam is capable of accommodating the design flood without overtopping.

b. Experience Data

The dam was originally designed to accommodate a 50-year frequency event of 1140 sec.-ft (Dam Appl. No. 539 dated October 1959). There are no streamflow records available nor any hearsay information that the dam has ever been overtopped in the past. As previously stated, the addition of the sheet-piled spillway has negligible effect on the capacity of the bridge waterway opening (the limiting hydraulic factor).

c. Visual Observations

The spillway structure appears to be in a satisfactory condition; however the bridge is the main feature of hydraulic interest. There

are two water/sewage lines which run across and through the bridge opening just upstream from the bridge. These pipes and their supports are the only features which could conceivably affect the hydraulic characteristics of the bridge as they presently restrict the hydraulic efficiency.

d. Overtopping Potential

As there are no records of the dam being overtopped and the fact that the spillway can easily accommodate the design flood, there is little potential for overtopping. The depth of flow for the SDF flood is roughly 8 feet above spillway crest which is just slightly above low steel on the bridge superstructure.

e. Drawdown Potential

There are two 36" sluices which can be used for drawdown purposes but which now appear to be inoperable. As they presently lack any mechanism for opening them, and the sluices are submerged much of the time, there is little potential for a rapid drawdown. The normal high tide elevation is only about one foot below spillway crest elevation. Hence, although drawdown is possible, no definitive and meaningful time-frame is established.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation

The interlocked steel sheet piling spillway is in overall good condition although the welding details at the top channel cap are not in the best standard practice. The concrete apron slab is continually submerged so it could not be closely observed. However, there has been no appreciable shifting or settlement of the sheeting and the apron is adjudged to be structurally intact. Because of the constant tidal fluctuation and small drainage area, the normal flows thru the structure are exceedingly modest and no evidence of downstream scour was noted. The exposed surfaces of the sheeting show little signs of excessive oxidation and appear to be of a good grade of marine structural steel. The exact weight and section modulus is unknown but due to the double-walled configuration, and monolithic cap, bending stresses are very low. The stone masonry bridge abutments which form an integral part of the dam structure are in satisfactory condition. They exhibit no appreciable differential settlement or tilting and are considered to be very conservatively designed. As previously stated in Section 3, the rubble masonry retaining walls that extend beyond the true bridge wingwalls (paralleling the roadway) are exceeding old and in poor condition. However, their collapse would have little adverse effect on the dam.

b. Design and Construction Data

Although design information was not available, due to the depth of sheeting and its configuration, the spillway is felt to be more than adequate for the hydraulic loads involved. Certainly, as long as no downstream scouring occurs to undercut the outfall sheetline,

bending stresses are extremely low and of little concern. Nothing is known regarding difficulties encountered during construction except that the layout for the northwest wing was slightly modified. Due to the nature of the soft underlying brown and black marine clay and silt deposits, it is fairly certain that little difficulty was encountered in driving the interlocking sections.

c. Operating Records

See Section 4. According to City personnel, the operation of this dam has been satisfactory.

d. Post Construction Changes

There is no record of any structural modifications since the initial construction was completed.

e. Seismic Stability

The dam is in zone I and due to its location, geometry and size, has negligible potential vulnerability due to seismic loadings. Experience indicates that the dam will have adequate stability under dynamic loadings if stable under static loadings.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/
PROPOSED REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

The Woodbury Creek Dam is assessed to be in an overall safe structural and hydraulic condition. It forms an artificial pond of less than 50 acres and was built principally to form a small recreational park facility (and as a mosquito-control measure). The spillway can safely withstand a reservoir head up to the tops of the wingwalls (4 feet) and there is little likelihood that the roadway and embankment which forms the dam could ever be overtopped. Summarizing the hydraulic considerations in Section 5, there is minimal downstream hazard should the spillway structure collapse. Consequently, the dam is downgraded to a low hazard category. The appended computations shown that the structure can accommodate the 100 year frequency SDF. No detrimental findings were revealed in this inspection to render a questionable judgement as to the hydraulic or structural adequacy.

b. Adequacy of Information

The information gathered for the Phase I inspection is deemed to be adequate regarding the safe operation and structural stability of the dam, especially in view of the hydraulic conclusions contained herein.

c. Urgency

Further studies are deemed unnecessary and it is recommended that the remedial measures set forth below be taken under advisement in the future.

d. Necessity for Further Study

Additional inspections are believed to be unnecessary as the dam does not constitute a hazard to human life or to be a danger to downstream property should it collapse.

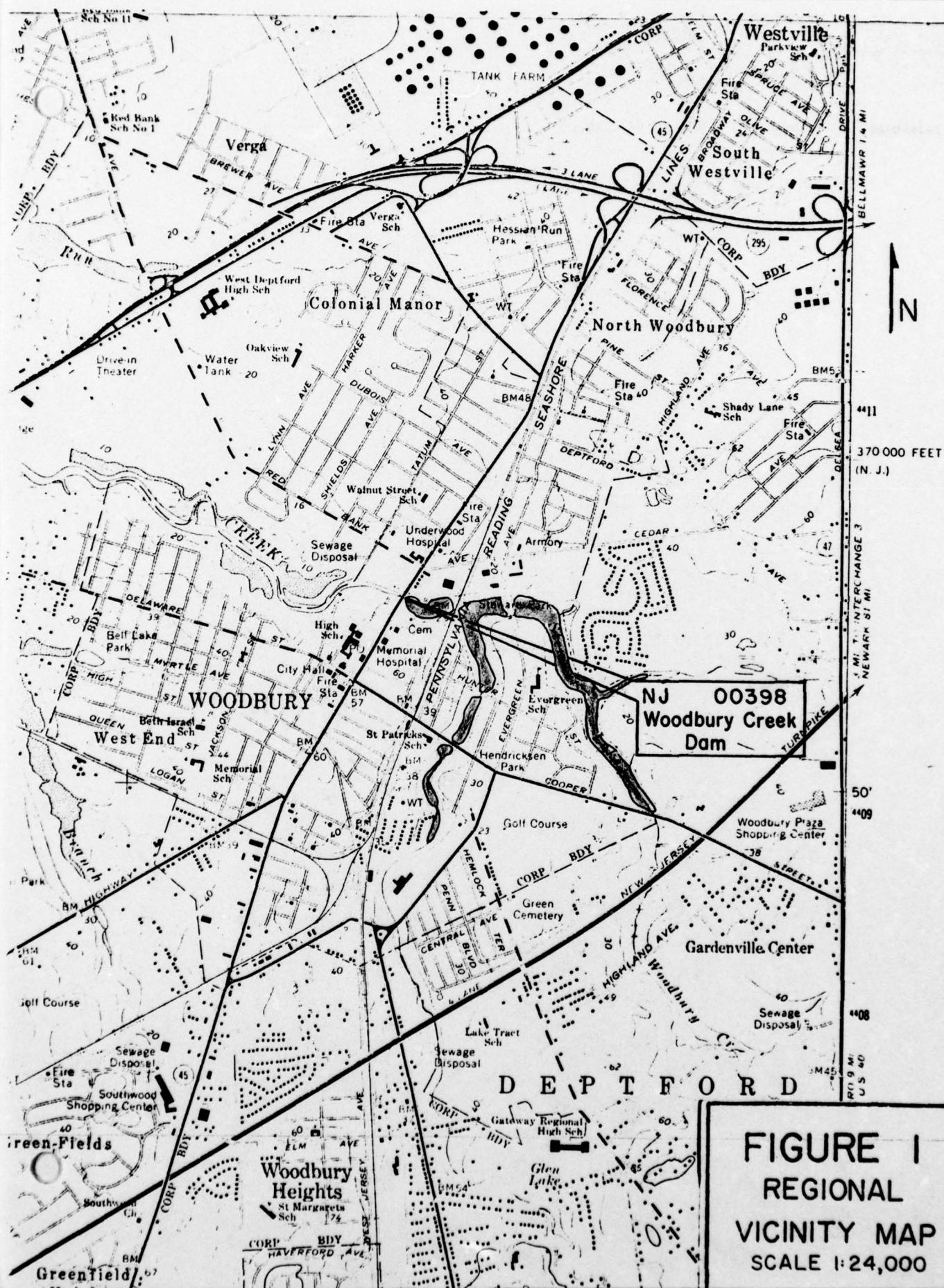
7.2 RECOMMENDATIONS/REMEDIAL MEASURES

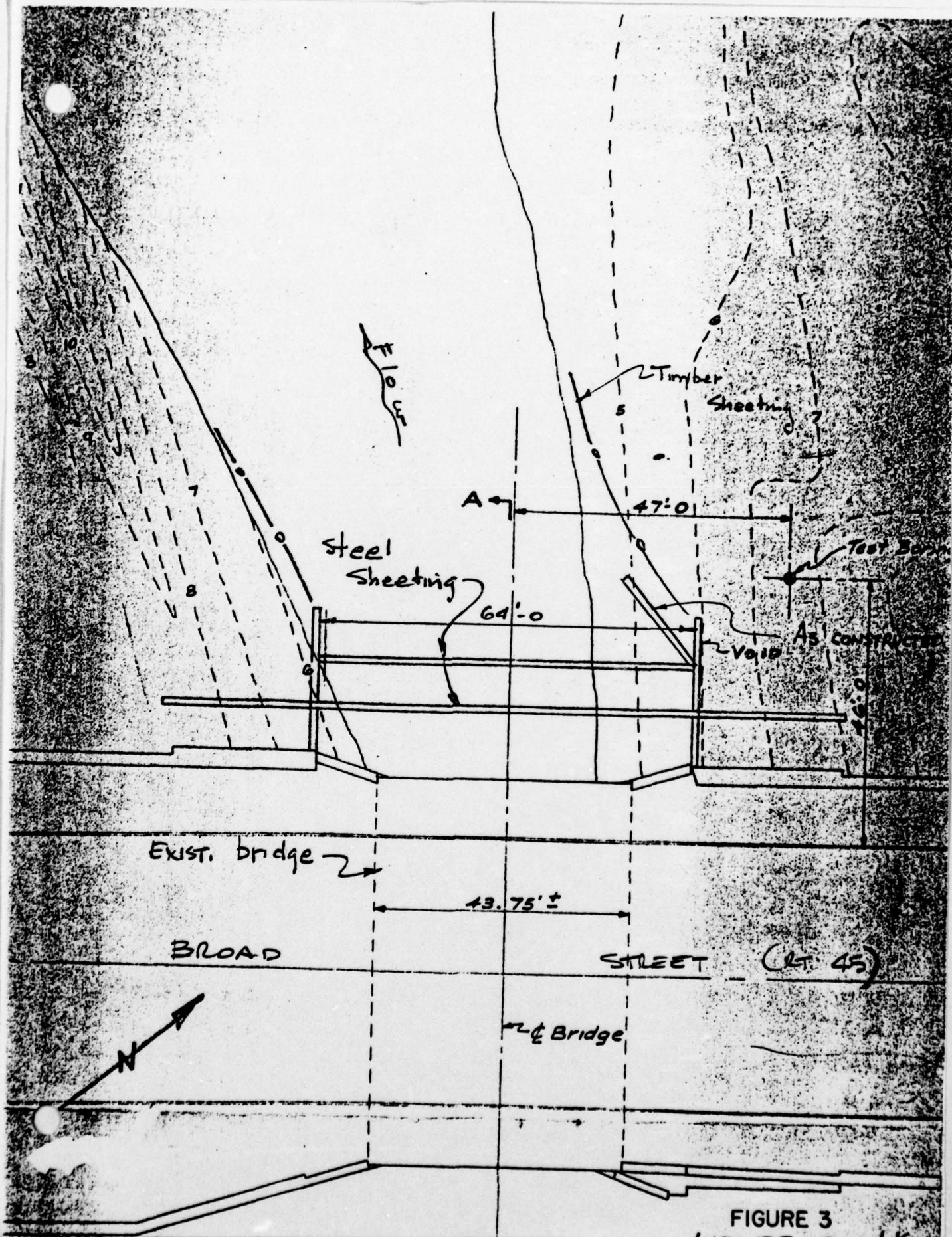
a. Alternatives

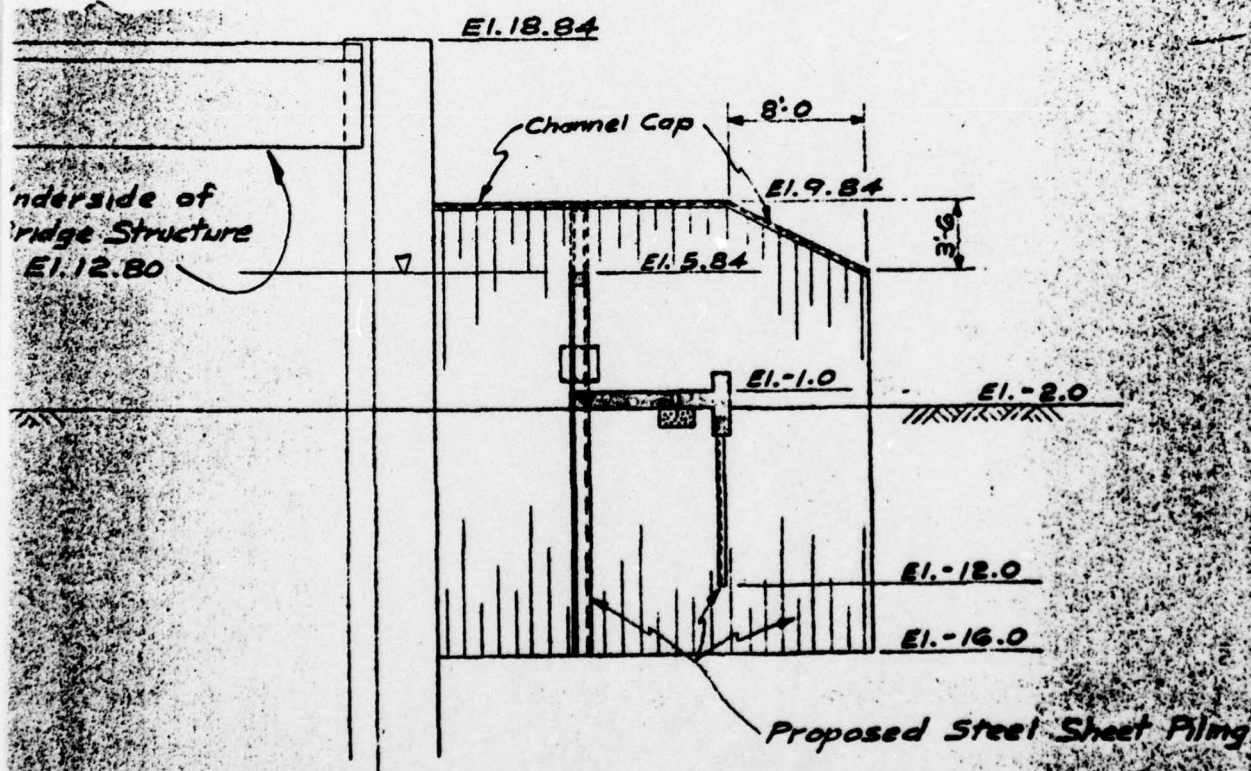
It is suggested that in the future, the owner review the possibility of relocating the utility lines that parallel the east, upstream fascia of the bridge. Also, the rubble masonry retaining walls beyond the bridge wings will require extensive repairs in the future.

b. O&M Maintenance and Procedures

No additional procedures other than those currently in effect appear to be warranted in light of the above assessment.







SECTION THRU SPILLWAY

FIGURE 4
WOODBORY

Check List
Visual Inspection
Phase 1

Name Dam Woodbury Creek County Gloucester State New Jersey Coordinators N.J.D.E.P.

Date(s) Inspection 12/5 & 6/78 Weather Clear Temperature 40°

Pool Elevation at Time of Inspection + 6.0 M.S.L. Tailwater at Time of Inspection + 3.0 M.S.L.

Inspection Personnel:

K. Jolls	<u>E. Simone</u>
D. Lang	<u></u>
M. Carter	<u></u>

K. Jolls Recorder

Dam No. 00398

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

SEE PAGE ON LEAKAGE

STRUCTURE TO
ABUTMENT/EMBANKMENT
JUNCTIONS

Satisfactory - Roadway embankment

Abutment limits very ill-defined

DRAINS

Curb inlets on roadway

WATER PASSAGES

None

FOUNDATION

Steel sheeting - appears solid

one section poorly driven but all sections interlocked properly

Old bridge abutment founded on timber piling

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
URFACE CRACKS ONCRETE SURFACES	Stone masonry abutments on bridge (badly cracked joints).	Large, massive stone. Little differential settlement.
STRUCTURAL CRACKING	Stone retaining walls badly cracked beyond bridge wingwalls.	Bridge superstructure very old deck length 43.75' (clear span approximately 35')
VERTICAL AND HORIZONTAL ALIGNMENT	Satisfactory	Roadway profile in sag vertical curve.
MONOLITH JOINTS	None	
CONSTRUCTION JOINTS	None observed	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	Roadway appears in good condition. Asphalt resurfaced several times. Minor cracking and settlement only at catch basin inlets.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	Some surface drainage runs down toe of embankment at southwest corner.
SLOUGHING OR EROSION OF EMBANKMENT AND ADJUTENT SLOPES	None - well grassed slopes with small trees and shrubs, landscaped. Minor brush and debris at Southeast corner.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Very uneven in elevation (roadway in sag vertical curve on highway) Width of roadway = 70'; 4-12' lanes, 2-10' sidewalks	
RIPRAP FAILURES	None (no riprap)	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Satisfactory	Roadway approach embankment which forms dam embankment is all well above (9'+) maximum flood elevation and is of minor importance.
ANY NOTICEABLE SEEPAGE	None observed	
STAFF GAGE AND RECORDER	None	
DRAINS	None (except roadway catch basins above)	

JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM

Satisfactory

Roadway approach embankment which forms dam embankment is all well above (9'+) maximum flood elevation and is of minor importance.

ANY NOTICEABLE SEEPAGE

None observed

STAFF GAGE AND RECORDER

None

DRAINS

None (except roadway catch basins above)

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None, entire outlet structure is steel sheeting.	
INTAKE STRUCTURE	Submerged - 2-36" ϕ Armco slide gates below spillway.	Operating handles not present. Operational condition unknown but satisfactory (City Engineering Department).
OUTLET STRUCTURE	Steel sheeting surrounding 2-36" ϕ flap gates	36" ϕ pipes extend about 12" out from spillway face.
OUTLET CHANNEL	Clear - no obstructions Channel approximately 80-100' wide	Steel sheeting tapers in from 64' spillway width to approximately 40' on right side of spillway.
EMERGENCY GATE	None	

UNCATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None - entire spillway structure constructed of steel sheeting.	Sheeting driven to a depth of -16.0 M.S.L.
APPROACH CHANNEL	None - Broad Street Lake directly above bridge and spillway.	Partially obstructed by 1-15" ϕ sewer pipe and 1-18" ϕ water/sewer pipe. Constricted by bridge abutments.
DISCHARGE CHANNEL	See previous page	
BRIDGE AND PIERS	None	

CATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	



INSTRUMENTATION			REMARKS OR RECOMMENDATIONS
VISUAL EXAMINATION MONUMENTATION/SURVEYS	OBSERVATIONS		
	None		
OBSERVATION WELLS	None		
WEIRS	None		
PIEZOMETERS	None		
OTHER	None		

RESERVOIR

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

Good condition.
Grassed and stabilized.

Flat slopes
divided into several ponds by bridges and embankments

SLOPES

Mirror

SEDIMENTATION

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CONDITION

(OBSTRUCTIONS, DEBRIS, ETC.)	None - trees and brush on banks deteriorated wooden bulkhead along both embankments for approximately 250' tidal.	
---------------------------------	--	--

SLOPES

Flat

APPROXIMATE NO.
OF HOMES AND
POPULATION

None - hospital parking lot, athletic field and apartments all above spillway crest
elevation.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Available *
TYPICAL SECTIONS OF DAM	Available *
HYDROLOGIC/HYDRAULIC DATA	Available *
OUTLETS - PLAN	Available
- DETAILS	Available
- CONSTRAINTS	Available
- DISCHARGE RATINGS	Available
RAINFALL/RESERVOIR RECORDS	Available

* N.J.D.E.P.

ITEM

DESIGN REPORTS

REMARKS

Not available

GEOLOGY REPORTS

Not available

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

Available (Application permit)
Available
Not available
Not available

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

Not available
Not available
Not available
Not available

POST-CONSTRUCTION SURVEYS OF DAM Not available

BORROW SOURCES.

N/A

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	Not available

ITEM	REMARKS
------	---------

SPILLWAY PLAN

Available

SECTIONS

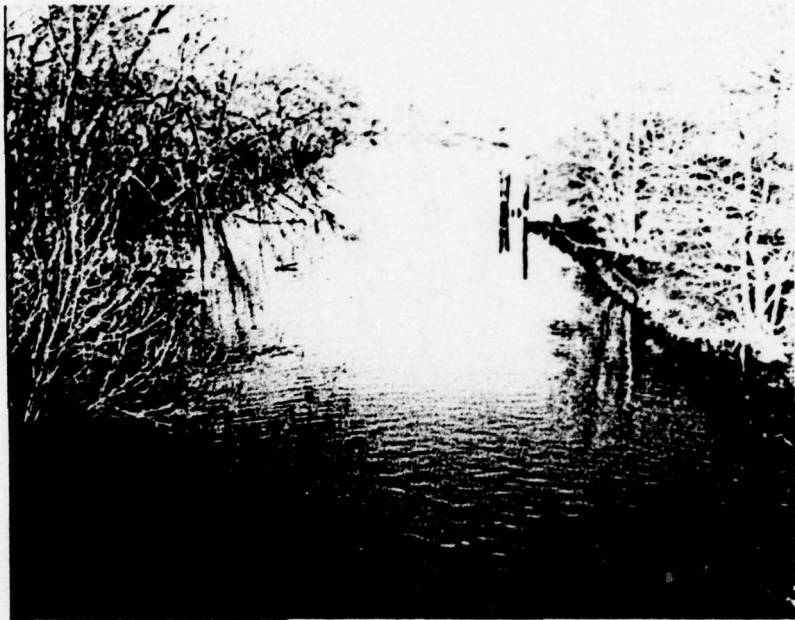
Available

DETAILS

Not available

OPERATING EQUIPMENT
PLANS & DETAILS

Not available



View of downstream channel from highway bridge

December 1978



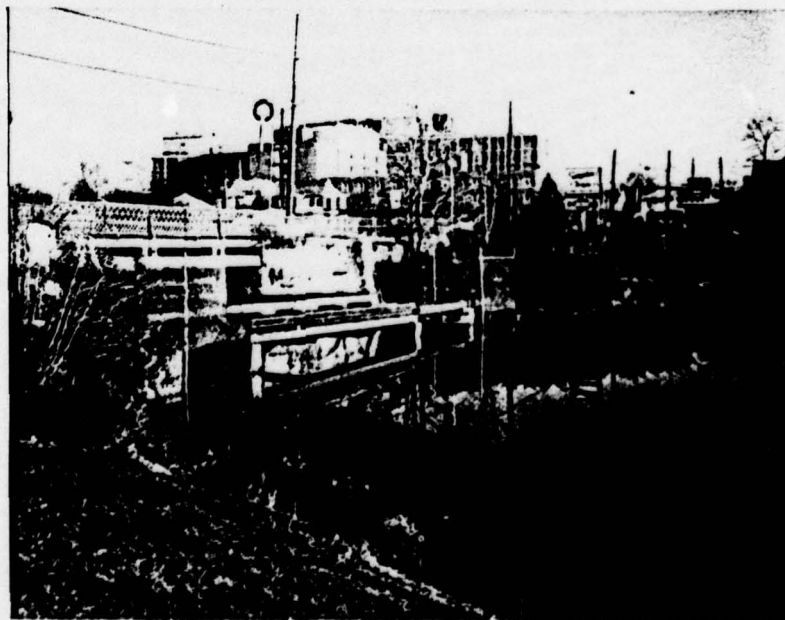
View East of Broad St. Lake and railroad bridge

December 1978



View West of Broad St. Lake and dam

December 1978



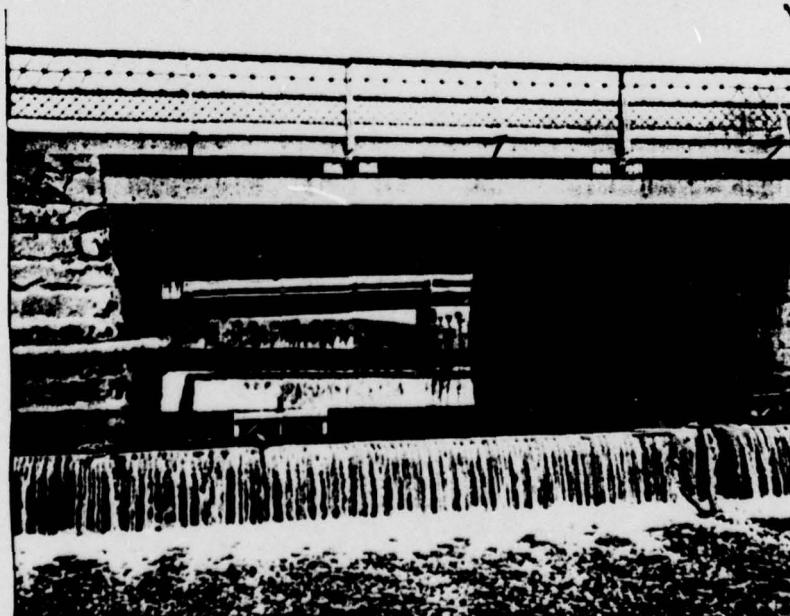
Water/Sewer lines across bridge opening

December 1978



Deteriorated wooden bulkhead downstream

December 1978



View upstream through bridge opening

December 1978

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATADRAINAGE AREA CHARACTERISTICS: Drainage Area = 5.0 sq.mi.ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): + 6.0 M.S.L. (390 acre-feet)ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): + 9.84 (597 acre-feet)ELEVATION MAXIMUM DESIGN POOL: + 8.92 M.S.L.ELEVATION TOP DAM: + 18.8+ M.S.L. (roadway surface Rt. 45)

CREST: _____

- a. Elevation + 5.84 M.S.L.
- b. Type Steel sheet piling, sharp crested weir
- c. Width 1 (one) ft.
- d. Length 64'
- e. Location Spillover Entire Length
- f. Number and Type of Gates 2-36" ϕ Armco Slide Gates

OUTLET WORKS: None

- a. Type _____
- b. Location _____
- c. Entrance inverts _____
- d. Exit inverts _____
- e. Emergency draindown facilities _____

HYDROMETEOROLOGICAL GAGES: None

- a. Type _____
- b. Location _____
- c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE: 1300+ cfs

BY DL DATE 12-78

CHKD. BY _____ DATE _____

SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

WOODBURY CREEK DAM

CALCULATION OF T_c

SHEET NO. A1 OF _____

PROJECT C-226

Calculation of T_c (U.S. Navy & Texas Highway Dept.)

①

Channel Length - 13,600'

Elev. diff. - 34'

Slope - $34/13,600 = 0.2\%$ $T_1 = 1.90$

say vel. = 2 ft/s. in channel

Overland flow

Length - 2400'

Elev. diff. - 46'

Slope - 2%

say vel. = 1.5 ft/s

$T_{10} = .40$

$\Sigma T = T_c = 2.30$

② T_c from Nomograph pg. 71 'Design of Small Dams'

$T_c = 2.00$ hours

\therefore use $T_c = 2.20$

$$T_p = \frac{D}{2} + 0.6 T_c$$

$$T_p = \frac{.25}{2} + 0.6 (2.20)$$

$$T_p = 1.45$$

BY D. L. DATE 12-78
 CHKD. BY _____ DATE _____
 SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

WOODBURY CREEK DAM

SHEET NO. A.2 OF _____
 PROJECT C-226

$$\Delta T = 0.25 \quad T_p = 1.45 \quad Q_p = \frac{484 \times 5.0 \times 1}{1.45} = 1669 \text{ cfs}$$

<u>$\Sigma \Delta T$</u>	<u>$\Sigma \Delta T / T_p$</u>	<u>D.O.</u>	<u>DISCHARGE</u>
0.25	.172	.058	97
0.50	.345	.214	357
0.75	.517	.459	766
1.00	.690	.753	1257
1.25	.862	.940	1568
1.50	1.034	.993	1658
1.75	1.207	.914	1526
2.00	1.379	.769	1283
2.25	1.552	.608	1015
2.50	1.724	.473	790
2.75	1.897	.372	620
3.00	2.069	.288	481
3.25	2.241	.228	380
3.50	2.414	.1765	295
3.75	2.586	.1335	223
4.00	2.759	.1046	175
4.25	2.931	.0830	138
4.50	3.103	.0670	112
4.75	3.276	.0535	89
5.00	3.448	.0401	67
5.25	3.621	.0317	53
5.50	3.793	.0244	41
5.75	3.966	.0194	32
6.00	4.138	.0155	26
6.25	4.310	.0124	21
6.50	4.483	.0093	16
6.75	4.655	.0074	12
			<u>13098</u>

Obtain from pg. 74 'Design of Small Dams'
 assumed straight lines between points on curve except
 on points of inflection.

BY D.L. DATE 12-78

CHKD. BY _____ DATE _____

SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

WOODBURY CREEK DAM
PRECIPITATION DATA TP-40

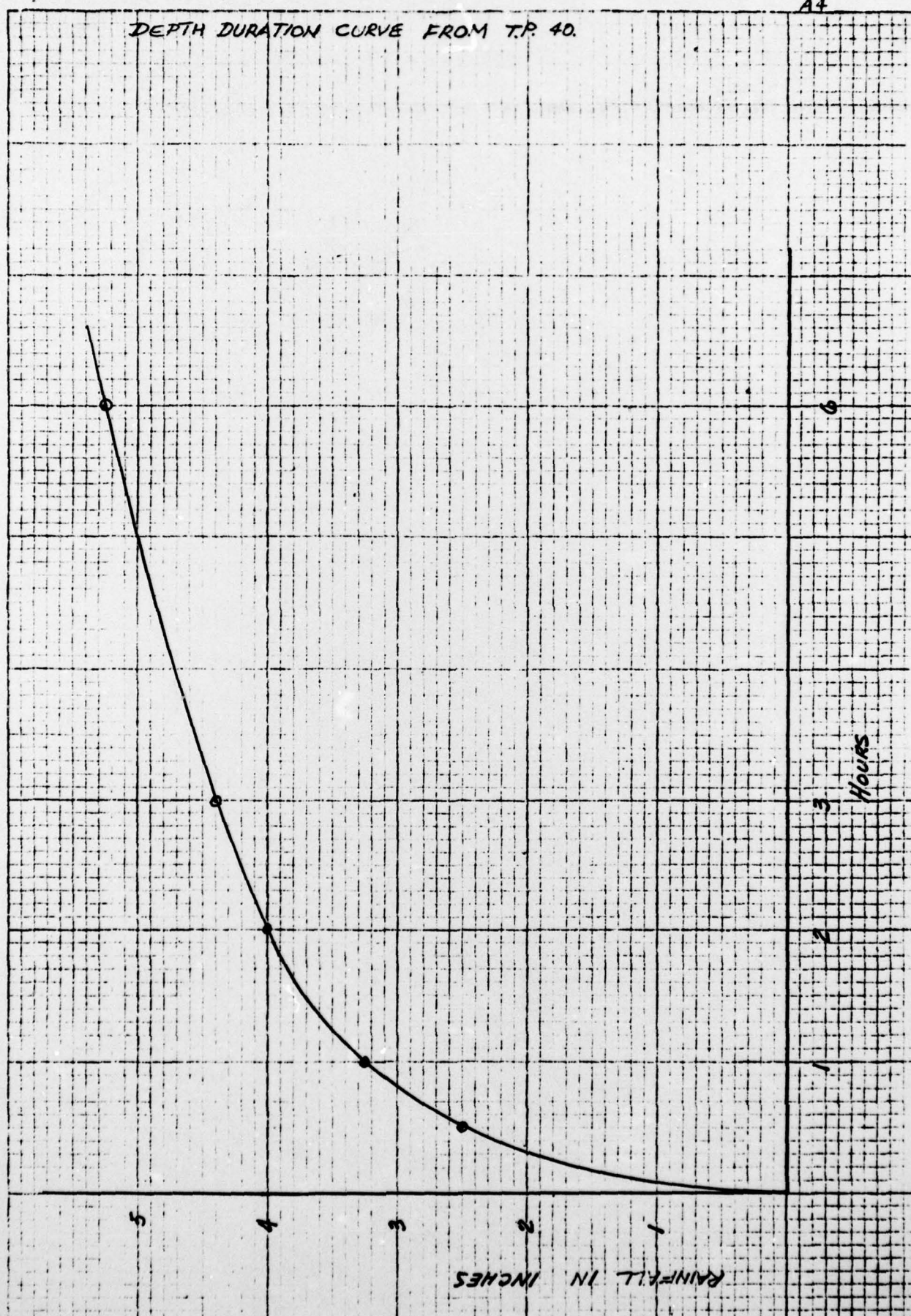
SHEET NO. A3 OF _____

PROJECT C-226

DATA FROM TP-40 100 yr. EVENT
(CURVE OVERLEAF)

<u>Time (hr.)</u>	<u>Rainfall (in.)</u>	<u>ΔR</u>	<u>Rearrange Δ</u>
0.25	1.80	1.80	0.06
0.50	2.50	0.70	0.06
0.75	2.90	0.40	0.06
1.00	3.25	0.35	0.07
1.25	3.50	0.25	0.07
1.50	3.70	0.20	0.07
1.75	3.87	0.17	0.08
2.00	4.00	0.13	0.09
2.25	4.10	0.10	0.10
2.50	4.20	0.10	0.10
2.75	4.30	0.10	0.10
3.00	4.40	0.10	0.10
3.25	4.47	0.07	0.35
3.50	4.55	0.08	0.40
3.75	4.64	0.09	0.70
4.00	4.71	0.07	1.80
4.25	4.79	0.08	0.25
4.50	4.87	0.08	0.20
4.75	4.93	0.06	0.17
5.00	5.00	0.07	0.13
5.25	5.07	0.07	0.08
5.50	5.13	0.06	0.08
5.75	5.19	0.06	0.07
6.00	5.25	0.06	0.06

DEPTH DURATION CURVE FROM T.P. 40.



BY D.J.M. DATE 12-78

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 45 OF

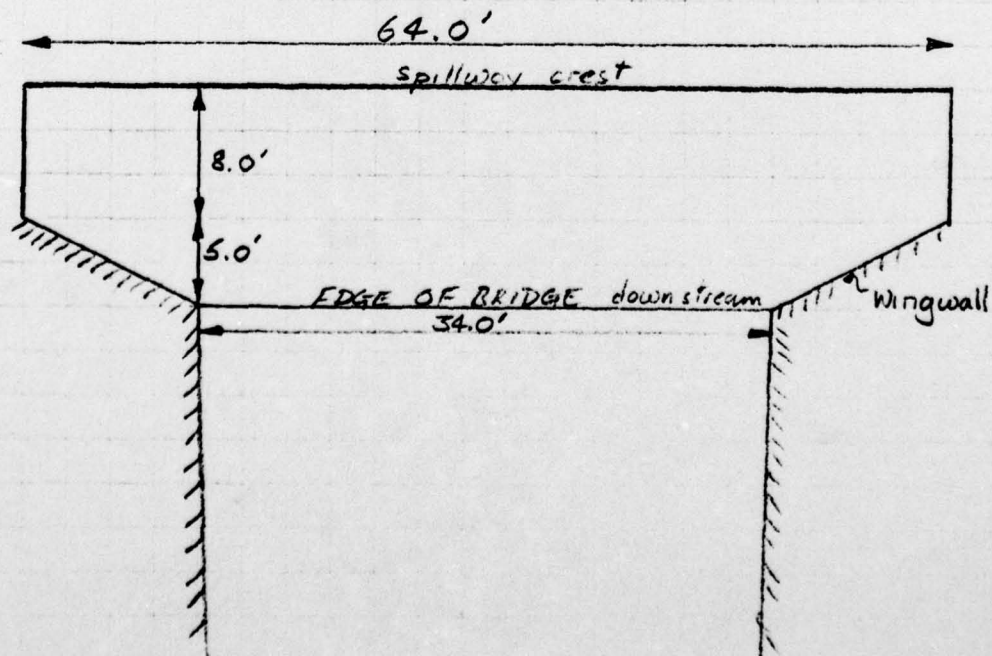
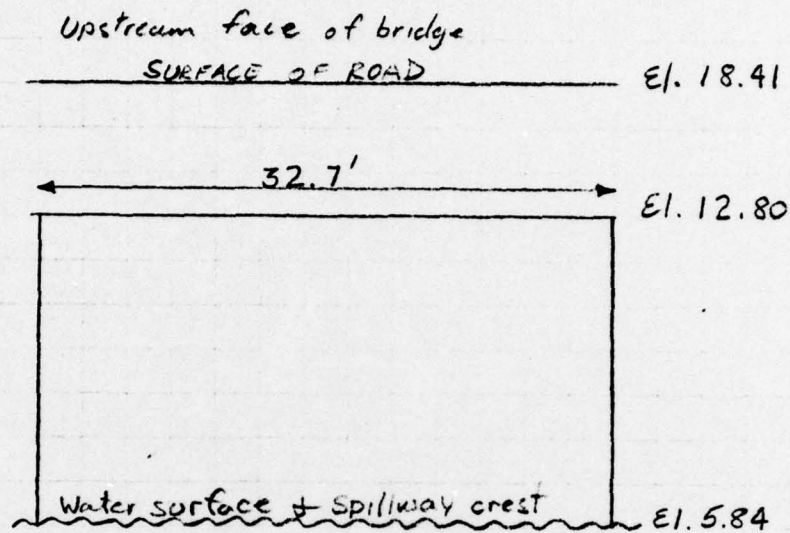
CHKD. BY _____ DATE _____

WOODBURY CREEK DAM INSPECTION

PROJECT C226

SUBJECT _____

Spillway discharge



BY D J M DATE 12-78

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A6 OF CHKD. BY DATE

WOODRURY CREEK DAM INSPECTION

PROJECT C 226SUBJECT Spillway discharge

Spillway discharge ignoring bridge 15' upstream:

Length = 64.0'

C = 30

H (ft) Q (cfs)

1 192

2 543

3 998

4 1536

5 2145

6 2822

7 3556

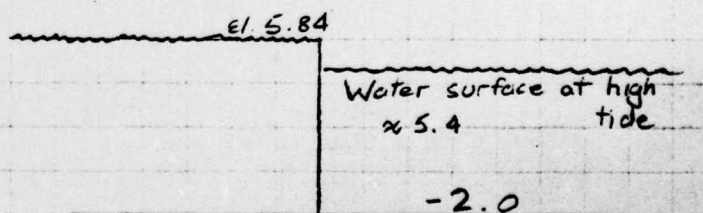
9.5 5622

Through bridge opening

Backwater effects for weir flow
were not considered

El. 12.80 underside of bridge

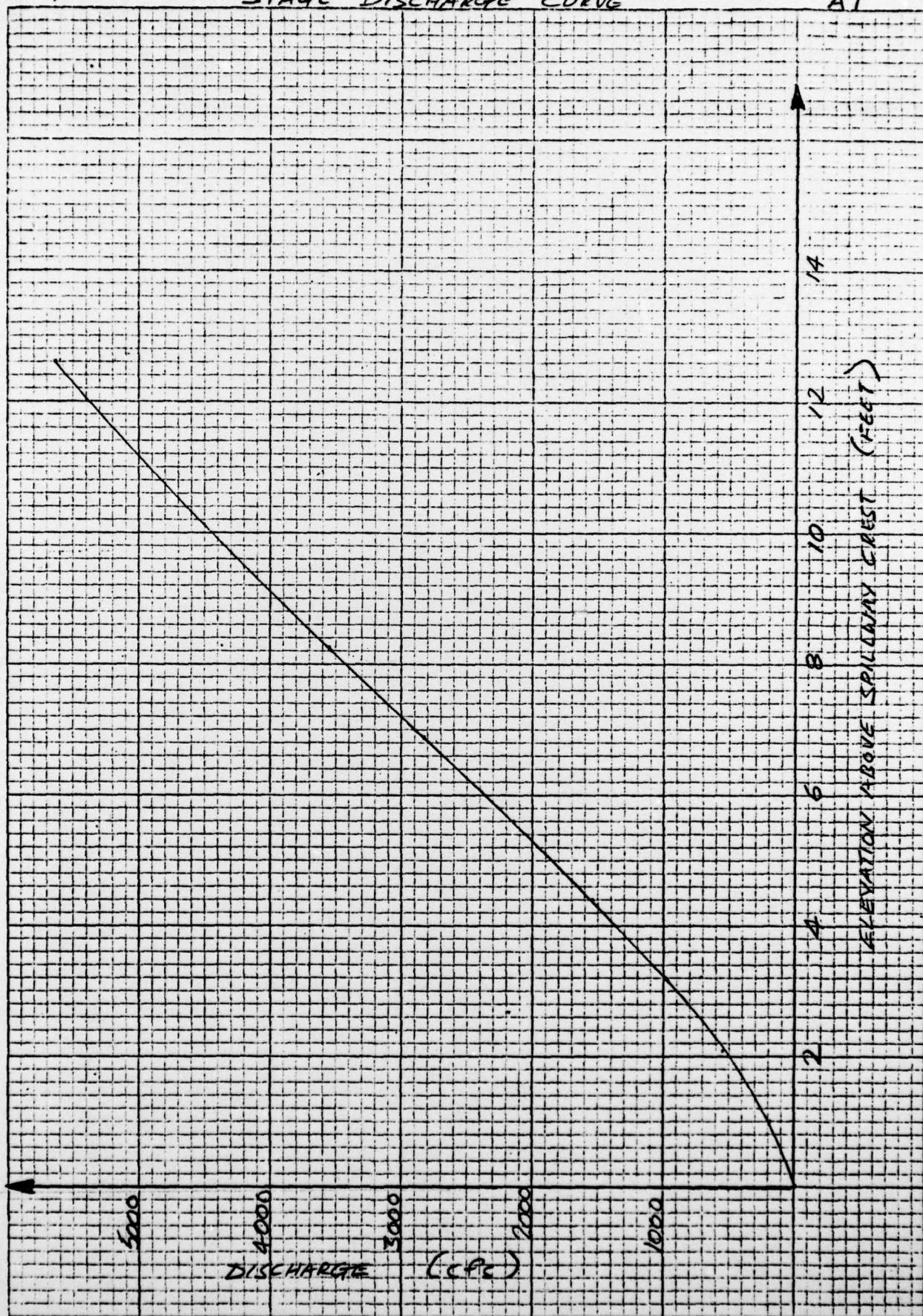
$$\text{Velocity head} = \frac{v^2}{2g}$$

use 1.5 x V.H. to account
for all losses

For H over spillway of	Submerged area under bridge upstream	Velocity = ft/s	Velocity head ((x1.5)(S.F)) = H + 2 V.H.	LAKE EL.
1'	= 8.84 x 32.7 = 289	0.66	0.01	1.01
2'	= 9.84 x 32.7 = 322	1.69	0.07	2.07
3'	= 10.84 x 32.7 = 354	2.82	0.19	3.19
4'	= 11.84 x 32.7 = 387	3.97	0.37	4.37
5'	= 12.84 x 32.7 = 420	5.11	0.61	5.61
6'	= 13.84 x 32.7 = 453	6.23	0.90	6.90
7'	= 14.84 x 32.7 = 486	7.33	1.25	8.25
9.5'	= " " = 485	11.59	3.13	12.63

STAGE DISCHARGE CURVE

A7



10" x 10" to 14" x 14" ALUMINUM
KEUFFEL & ESSER CO.

BY D.I.M. DATE 12-78

CHKD. BY _____ DATE _____

SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

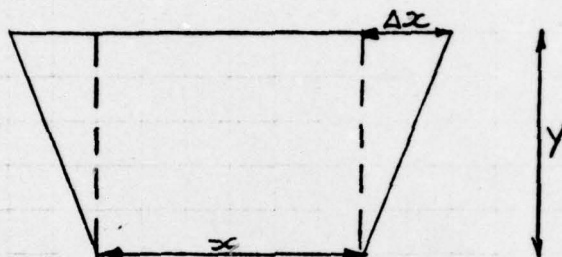
WOODRUCKY CREEK DAM INSPECTION

SHEET NO AB OF _____

PROJECT C226

Area of lake @ El. 5.84 \approx 49 acres

Area of contour @ El. 20.00 \approx 67.6 acres



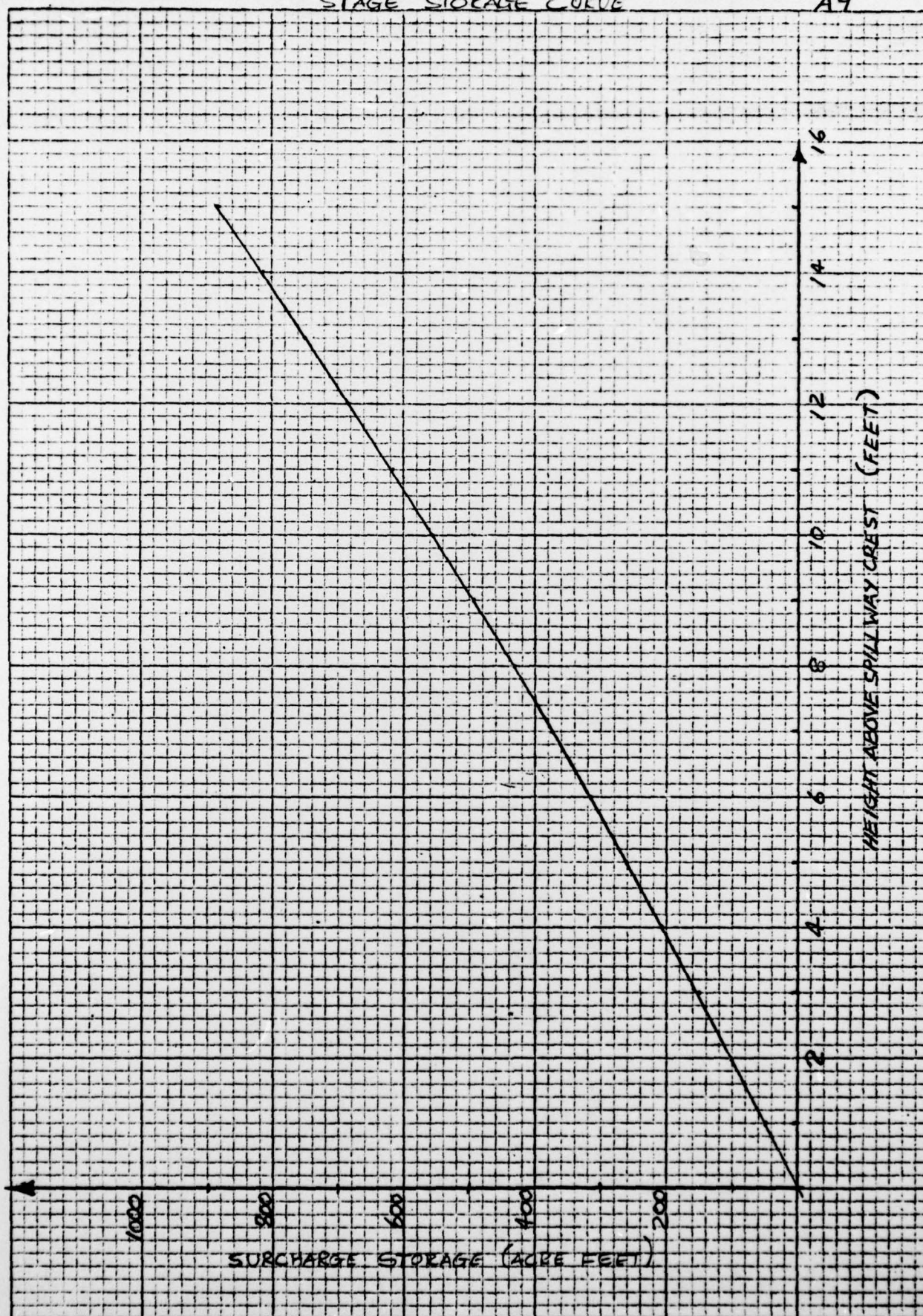
FORMULA FOR EACH INCREMENT IN VOLUME $\Delta V = (x + \Delta x) \times y$

<u>H</u> <u>FEET</u>	<u>STORAGE</u> <u>ACRE FEET</u>
1	50
2	101
3	153
4	207
5	261
6	318
7	375
8	434
9	494
10	556
11	618
12	683
13	748
14	815
15	883

@ 12.63 \approx 724 A.F

STAGE STORAGE CURVE

A9



BY D. J. M. DATE 12-78
CHKD. BY _____ DATE _____
SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.
WOODBURY CREEK DAM INSPECTION

SHEET NO. A10 OF ____
PROJECT C226

SUMMARY OF STORAGE & DISCHARGE DATA FOR
HEC-1 COMPUTER PROGRAM.

HEIGHT ABOVE SPILLWAY CREST	STORAGE	DISCHARGE
<u>(FEET)</u>	<u>(ACRE FEET)</u>	<u>(CFS)</u>
2	101	500
4	207	1370
6	318	2370
7	375	2900
8	434	3410
9	494	3950
10	556	4440
11	618	4920
12	683	5390
12.63	724	5622

BY DJM DATE _____
CHKD. BY _____ DATE _____
SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.
WOODBURY CREEK DAM

SHEET NO. A11 OF _____
PROJECT C-226

WOODBURY CREEK DAM INSPECTION SOUTH GROUP C226

RY D.J.MULLIGAN
DECEMBER 1978

JOB SPECIFICATION
NO MHR MMIN IDAY IHR IMIN METRC IPLT IPRT NSTAN
100 0 15 0 0 0 0 0 0 0 0
JOPER NWI
3 0

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH FOR 100-YEAR FREQUENCY EVENT

ISTAG ICOMP IECON ITAPE JPLT JPRT INANE
3 0 0 0 0 0 0 1

HYDROGRAPH DATA

IMYDG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
0 -1 5.00 0.0 5.00 0.0 0.0 0 0 0

PRECIP DATA

NP STORM DAK
24 0.0 0.0 0.0

PRECIP PATTERN

0.06 0.06 0.06 0.07 0.07 0.07 0.07 0.08 0.09 0.10 0.10
0.10 0.10 0.35 0.40 0.70 1.80 0.25 0.20 0.17 0.13
0.08 0.07 0.06

LOSS DATA

STMR DLTKR RTIOL ERAIN STRKS RTIOL STRTL CNSTL ALSMX RTIMP
0.0 0.0 1.00 0.0 0.0 1.00 0.50 0.10 0.0 0.0

GIVEN UNIT GRAPH, MUHGG= 27

97. 357. 766. 1257. 1568. 1658. 1526. 1283. 1015. 790.
620. 481. 380. 295. 223. 175. 138. 112. 89. 67.
53. 41. 32. 26. 21. 16. 12.

UNIT GRAPH TOTALS 13098. CFS OR 1.02 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.0 QRCSN= 0.0 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME RAIN EXCS COMPO
1 0.06 0.00 0.
2 0.06 0.00 0.
3 0.06 0.00 0.
4 0.07 0.00 0.
5 0.07 0.00 0.
6 0.07 0.00 0.
7 0.08 0.00 0.
8 0.09 0.04 4.

BY DJM DATE _____
CHKD. BY _____ DATE _____
SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.
Woodbury Creek Dam

SHEET NO. A12 OF _____
PROJECT C 226

9	0.10	0.07	23.
10	0.10	0.07	67.
11	0.10	0.07	146.
12	0.10	0.07	254.
13	0.35	0.32	399.
14	0.40	0.37	612.
15	0.70	0.67	955.
16	1.80	1.77	1606.
17	0.25	0.22	2599.
18	0.20	0.18	3805.
19	0.17	0.14	4955.
20	0.13	0.10	5605.
21	0.08	0.05	5694.
22	0.08	0.05	5290.
23	0.07	0.05	4630.
24	0.06	0.04	3902.
25	0.0	0.0	3242.
26	0.0	0.0	2678.
27	0.0	0.0	2184.
28	0.0	0.0	1769.
29	0.0	0.0	1406.
30	0.0	0.0	1100.
31	0.0	0.0	866.
32	0.0	0.0	681.
33	0.0	0.0	539.
34	0.0	0.0	423.
35	0.0	0.0	327.
36	0.0	0.0	256.
37	0.0	0.0	199.
38	0.0	0.0	155.
39	0.0	0.0	123.
40	0.0	0.0	94.
41	0.0	0.0	69.
42	0.0	0.0	47.
43	0.0	0.0	20.
44	0.0	0.0	14.
45	0.0	0.0	9.
46	0.0	0.0	6.
47	0.0	0.0	3.
48	0.0	0.0	2.
49	0.0	0.0	1.
50	0.0	0.0	0.
51	0.0	0.0	0.
52	0.0	0.0	0.
53	0.0	0.0	0.
54	0.0	0.0	0.
55	0.0	0.0	0.
56	0.0	0.0	0.
57	0.0	0.0	0.
58	0.0	0.0	0.
59	0.0	0.0	0.
60	0.0	0.0	0.
61	0.0	0.0	0.
62	0.0	0.0	0.
63	0.0	0.0	0.
64	0.0	0.0	0.
65	0.0	0.0	0.
66	0.0	0.0	0.
67	0.0	0.0	0.

LOUIS BERGER & ASSOCIATES INC.
Woodbury Creek Dam

SHEET NO. A13 OF
PROJECT C226

70	0.0	0.0	0.0
71	0.0	0.0	0.0
72	0.0	0.0	0.0
73	0.0	0.0	0.0
74	0.0	0.0	0.0
75	0.0	0.0	0.0
76	0.0	0.0	0.0
77	0.0	0.0	0.0
78	0.0	0.0	0.0
79	0.0	0.0	0.0
80	0.0	0.0	0.0
81	0.0	0.0	0.0
82	0.0	0.0	0.0
83	0.0	0.0	0.0
84	0.0	0.0	0.0
85	0.0	0.0	0.0
86	0.0	0.0	0.0
87	0.0	0.0	0.0
88	0.0	0.0	0.0
89	0.0	0.0	0.0
90	0.0	0.0	0.0
91	0.0	0.0	0.0
92	0.0	0.0	0.0
93	0.0	0.0	0.0
94	0.0	0.0	0.0
95	0.0	0.0	0.0
96	0.0	0.0	0.0
97	0.0	0.0	0.0
98	0.0	0.0	0.0
99	0.0	0.0	0.0
100	0.0	0.0	0.0
SUM	5.25	4.28	56759.

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAYG	I'COMP	IECON	ITAPE	JPLT	JPRY	INAME
33	1	0	0	0	0	1

ROUTING DATA			
QLOSS	CLOSS	AVG	IRFS
0.0	0.0	0.0	1

INSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

	101.	207.	318.	375.	434.	556.	61A.	683.	724.
STORAGE=	500.	1370.	2370.	2900.	3410.	3950.	4920.	5390.	5622.
OUTFLOW=									

TIME	EOP	STOR	AVG IN	EOP OUT
1	0.	0.	0.	0.
2	0.	0.	0.	0.

BY DJM _____ DATE _____
CHKD. BY _____ DATE _____
SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.
Woodbury Creek Dam

SHEET NO. A14
PROJECT C226

LINE NO.	DESCRIPTION	AMOUNT	CHECK NO.	DATE	BANK	REMARKS
3		0.				
4		0.				
5		0.				
6		0.				
7		0.				
8		0.				
9		0.				
10		0.				
11		1.				
12		3.				
13		8.				
14		14.				
15		25.				
16		41.				
17		65.				
18		101.				
19		153.				
20		218.				
21		290.				
22		357.				
23		409.				
24		443.				
25		457.				
26		456.				
27		444.				
28		424.				
29		398.				
30		370.				
31		340.				
32		310.				
33		281.				
34		254.				
35		229.				
36		207.				
37		186.				
38		168.				
39		151.				
40		136.				
41		123.				
42		112.				
43		93.				
44		85.				
45		78.				
46		72.				
47		67.				
48		63.				
49		60.				
50		57.				
51		54.				
52		52.				
53		50.				
54		48.				
55		47.				
56		46.				
57		45.				
58		44.				
59		44.				
60		43.				
61		43.				
62		42.				
63		42.				

BY DJM DATE _____

CHKD. BY _____ DATE _____

SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

Woodbury Creek Dam

SHEET NO. A15 OF _____

PROJECT C226

64	42.	0.	12.
65	41.	0.	11.
66	41.	0.	9.
67	41.	0.	7.
68	41.	0.	6.
69	41.	0.	5.
70	41.	0.	5.
71	41.	0.	4.
72	40.	0.	3.
73	40.	0.	3.
74	40.	0.	2.
75	40.	0.	2.
76	40.	0.	2.
77	40.	0.	1.
78	40.	0.	1.
79	40.	0.	1.
80	40.	0.	1.
81	40.	0.	1.
82	40.	0.	1.
83	40.	0.	0.
84	40.	0.	0.
85	40.	0.	0.
86	40.	0.	0.
87	40.	0.	0.
88	40.	0.	0.
89	40.	0.	0.
90	40.	0.	0.
91	40.	0.	0.
92	40.	0.	0.
93	40.	0.	0.
94	40.	0.	0.
95	40.	0.	0.
96	40.	0.	0.
97	40.	0.	0.
98	40.	0.	0.
99	40.	0.	0.
100	40.	0.	0.

SUM 54818.

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
3620.	2116.	571.	548.	54818.
CFS	3.94	4.25	4.25	4.25
INCHES	1050.	1133.	1133.	1133.
AC-FT				

RUNOFF SUMMARY, AVERAGE FLOW

HYDROGRAPH AT	3	PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
ROUTED TO	33	5694.	2313.	591.	568.	5.00
		3620.	2116.	571.	548.	5.00